KNOWLEDGE AND WORKING GUIDANCE FOR THE ROCKET LAUNCHER AND EXPLOSIVE BOMBS CAL. 73 mm

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FOR THE ATTENTION OF THOSE OPERATING THE ROCKET LAUNCHER AND EXPLOSIVE BOMBS CAL. 73 mm

Before operating the rocket launcher it necessary that those concerned should get familiar with the instructions contained in the present guide and in particular the prescriptions concerning the observance of labor safety rules during operation of the weapon.

GENERAL DATA

The rocket launcher is made up of: barrel, breechblock and tripod mount.

The barrel serves to introduce in it the rounds and to direct the grenade and the explosive bombs flight. On the barrel there are: the breechblock catch, the catch mechanism and the extractor mechanism, the contact unit, the aiming device and handle for transport.

The tripod mount is designed for imputing the rocket launcher in firing position and to direct it by means of the horizontal and vertical aiming mechanisms at the target.

The generator is fixed to the tripod mount base and coupled with the contact device by means of screened insulated cable and by an electrical coupling.

The fitted trip lever on the generator is emplaced close by the knob for vertical aiming.

The trip lever shall be locked when the generator is cocked by means of the safety lock.

The firing line height changing of the rocket launcher is assured by the tripod mount construction, to allow the choosing of the firing position depending on the ground nature.

The maximum height of the firing line (in sitting down firing position) and the minimum height of the firing line are fixed in firing position. Each foot of the tripod mount irrespective of the other fast may be twisted at a certain angle what assure the quick mounting of the rocket launcher, even on a troubled land without a special preparing on the firing position.

In the defensive forms of fight for sheltering the rocket launcher crew special trenches will be prepared.

The displacement of the rocket launcher on the battle field is executed by the gun crew by its rising or drawing.

REMARKS

The breechblock lock is designed to maintain the breechblock in the opened position and has the shape of a mounted roll on a springy rod; when the breechblock is opened the roll enters into the respective groove of the breechblock ears and retain it in this position assuring the charging of the launcher with grenades or with explosive bombs.

The closing mechanism is designed to close the barrel bore and is made up of a key, which is placed in the square slot of breechblock, from a handle fixed on the upper part of the key and front the handle catch.

At the handle rotation at 90° counter-clockwise occurs the key raising; meanwhile the key enters into the locks of breechblock and executes the closing; at the handle rotation at 90° clockwise occurs the descendent and the opening of the barrel bore.

The catch holds back the handle against to untimely rotation; the breechblock rotation in the extreme position in front rank the handle breechblock-as a result of the interaction with the upper coking lug of the barrel, turns out from the handle notch and permits its rotation to execute the closing; in the closed position the breechblock enters in the second notch of the handle, fixing it self in the closed position.

The extractor mechanism is designed to take out the throwing charge elements from the barrel bore, which remained in the barrel after firing or the rounds if the firing with the charged rocket launcher was called of. The extractor mechanism is made up of two cylindrical pushers located symmetrically in two inclined orifices up and down from the chamber of barrel breechblock and from two bent levers, which are fixed by a joint by means of a vertical axle, at the left lug of the barrel breechblock chamber, the levers are fixed against falling by means of a lock fixed with joint on the lower lever, the lock which is coming out from the axle notch and in order that the lock do not turn freely it is fixed with a catch with spring, placed in the axle of the lever. At the breechblock rotation during the opening, the ear of the breechblock drives on the short arms of the levers and turn in this time the opposite hands of the levers his pusher heads, which in their turn drive on the diaphragm, throwing charge elements after firing. The contact and blocking devices are designed to supply the current produced by the generator to the diaphragm for ignition of the electric detonators located in the throwing charge at the firing execution and to exclude the eventual firings when the barrel bore is not completely closed.

The contact device is made up of contact body located on the chamber of barrel breechblock on which are mounted two curved levers, two contacts, introduced in orifices, which pass through the contacts body and barrel and retained in these orifices against falling with two special springs.

When the round is introduced in the rocket launcher the springs assure the contact with the contact ring of the diaphragm.

The blocking device is placed on the chamber of the barrel breechblock at right and is made up of a body and the pusher with spring, which break the electric circuit when the barrel bore is not completely closed.

When the barrel bore is completely closed the cam on the handle of the closing mechanism is pressing on the pusher moving it downwards and restores the electric circuit of the contact equipment.

The generator is designed to generate the necessary electric current for firing.

It is made up of an inductor assembled in an insulated body fixed at the tripod mount base.

In the same body there are the lever of cocking mechanism the trip lever (trigger) and the safety lock.

The aiming devices serves for orientation of the rocker launcher and explosive bombs to the target, the distance determination till the target, the observation of the battle field and the firing correction.

The aiming device is designed for orientation of the rocket launcher barrel to the target direction in vertical and horizontal plane and combined constructively two telescopes: telescope for direct aiming and telescope for indirect aiming.

Both telescopes are thus mounted that the line of sight of the telescope for direct aiming does not deviate in the working time with aiming telescope for indirect firing.

The presence of the adjustment mechanism of the horizontality for the calculation of the rocket launcher side inclination allowing the aiming accomplishing even when the rocket launcher in seated on the side inclinated ground.

The aiming telescope for direct firing consists of on optical sight with prism rectifier system.

The telescope is made up of an optical system, an adjusting mechanism of the target and reticule moving mechanism depending on the ambient average temperature, mounted in the telescope body. The optical system of the telescope for direct aiming is made up of protecting window, block of rectifier prism, target doublet, reticule, eyepiece formed of 5 lenses and light filter.

The telescope reticule for direct aiming is located in focusing plane of eyepiece thus that the scale for distance and aiming signs determination to be comprised entirely in the plane of vision, giving thus the shooter the possibility to observe the ground and accomplish the aiming without taking of his eye from the telescope eyepiece. On the telescope reticule are marked the following scales and signs:

a. **Sign +** (Fig. 5)

This sign is placed centrally in the upper part of reticule in a cross form. Sign which carries out the zero line of the telescope aiming, the origin where are calculated the sight angles both for cumulative round and for explosive round.

This sign serves to accomplish the parallelism adjustment between the zero aiming line of telescope for direct aiming with the axle of rocket launcher barrel adjustment which is accomplished either on a distant point on an adjustment panel, in factory (only on the panel) and in working.

The sign "+" is out of place with 1^o against the center of the field vision of telescope. In order as the aiming zero line which passing by the sign "+" to be parallel with the fixing road of the aiming device, the rectifier prisms system from the front of target is seated inclined in an angle of 30^o.

b. The open rear sight angle scale and the side correction scale for firing execution with cumulative round

The sign of open rear sight angle scale for cumulative round ("c" letter marked on the left reticule) are applied under thorn and vertical line shape, marked with figures 6, 8, 10 and 12 which correspond the distances of 600, 800, 1000 and 1200 m till target. The open rear sight angles corresponding to the distances of 700, 900, 1100 and 1300 m are not marked with figures.

The open rear sight angles - without taking into consideration the side correction – are marked in the central part under horn shape (less the open rear sight angles which corresponds to the distance of 600 m) the thorns has opening of the 60° with the exception of corresponding thorn of distance of 800 m which has opening of 90° and has bigger sides.

The signs of the side correction scale are applied under vertical line shape in the right and left of the central signs of aiming at the interval of 0-10 and respectively 0-20 against the central thorns.

The side correction scale allows the correction introduction by firing to moving targets. The signs of the side correction corresponding to the distance of 800 m contain both thorns and vertical lines, differing from the side corrections for the other distances which are made up only from vertical lines.

c. The open rear sight angles scale for direct firing execution with explosive round (Fig.)

The signs of the open rear sight angle for explosive round ("E" letter marked on the lower reticule) are applied under horizontal line shape for marking difference of the open rear sight angle signs for cumulative round and centrally placed on the vertical.

The first sign of this scale is placed immediately under the thorn which materialize the rear sight angle for distance of 900 m on the "C" scale and represents the open rear sight angles for the distance till the target of 200 m.

The scale is continued down by marking the open rear sight angles corresponding to the distances of 400, 600, 700, 800, 900, 1000, 1100, 1200 and 1300 m.

The rear sight angles corresponding to the distance of 600, 800, 1000 and 1200 m are marked with figures 6, 8, 10 respectively 12.

d. The scale for distance determination till the target (Fig. 5)

The scale is made up of two lines:

- a lower line – horizontal and continuous;
- an upper line – curved and discontinuous.

Under the continuous horizontal line there is marked the figure 2,7 which represent the target height for which is calculated the scale.

Above the discontinuous upper line are placed vertical lines, which marks the distances till target. The lines are marked from two in two with the figures 6, 8, 10 and 12 corresponding to the distances of 600, 800, 1000 and 1200 m.

For distance determination is necessary that the target image (of the tank) to be seated between the discontinuous curve an horizontal line thus the target contour to be tangent to both scale lines.

In this position the tangential point of the discontinuous curved line with the tank contour indicates the distance till the target.

e. The vertical line under the "E" letter

This line centrally placed, gives the possibility to the shooter to establish easier the lateral inclination of the rocket launcher, in the same time is serving to the vertical placing of the telescope reticule for direct aiming when is accomplished the adjustment of zero line on the panel.

THE ADJUSTEMENT DEVICE OF THE AIMING TELESCOPE FOR DIRECT FIRING (Fig. 1)

The adjustment device has slide in which is placed the objective The slide may vertically and horizontally moved between the plates, by rotating the vertical and horizontal adjusting screws 6, 2. These screws have a knurled surface in which under the spring 5 action enter the catches 4 which prevent the self-loosening of the adjustment screws. The adjustment screws are protected with covers 3, 7. The slide is pushed towards the heads of the adjustment screws by a spring 1.

THE MOVING DEVICE OF THE RETICLE DEPENDING ON THE ENVIRONMENT AVERAGE TEMPERATURE

The moving device of the reticule is made up of the support plate, the slide on which is mounted the reticule in enclosure, the screw the engagement nut, the temperature correction scale and the acting knob.

The moving of the line on the support plate is accomplished on two slide ways by rotating the acting knob. When rotating it drives the engagement nut solidarized with it.

The nut having not moving possibility in axial direction, acts over the screw, screwing it on or of.

Moving, the screw drives the slide on which is mounted the reticule. Over the slide acts also the springs, which take over the clearance of the mounting between the screw and the engagement nut. The turning of the knob and the moving of the slide limited by a pin.

The position for temperature correction "+"; "0" and "-" are fixed by means of an indexing system-ball with spring. The indexing is accomplished by the ball which penetrates under the spring action in one of the three channels with that is provided the scale, corresponding to the corrections "+"; "0" and "-".

TELESCOPE FOR INDIRECT AIMING (Fig. 2)

The telescope for indirect aiming consist of a bert optical sight and drifts mechanisms of angle of open rear sight and of angles of ground (the side level mechanism).

The optical system of the telescope for indirect aiming is mounted in the body, it consist of an objective 15 made up from a doublet, a prism with cover, reticule and from an eyepiece 16 made up from two doublets.

In the field of vision of the sight for successive aiming in the reticule with cross, by means of which is accomplished the aiming over the aiming point. In the left side, the visual body is provided a target – sight system for approximate aiming.

THE DRIFTS MECHANISM (Fig.2; 3)

The drifts mechanism serves for the angles determination in horizontal plane. The drifts mechanism has a spiral wheel which turns in eccentric and which may be acted by the lever. When turning the eccentric, together with the initial position under the spring acting, the worm enter meshes with the spiral wheel.

On the worm are fixed the knob 1 and the ring 3 (frig. 3) on which is marked the drifts scale with the division value of 0-01. In all on the scale there are 100 divisions, every tenth division being marked with figures. To a complete turning of the knob 1 corresponds a division of the drifts scale on the ring 4 (Fig. 3).

THE MECHANISM OF THE OPEN REAR SIGHT ANGLES (Fig. 2; 4)

This mechanism is designed for introducing the aiming angles on the open rear sight. It has a distance scale for the explosive grenade.

At the same time, it has two scales of thousandths, that approximate with the division value of 1-00 and that precise 5 with the division value of 0-01 which allows the introducing of the open rear sight angles from -10° till 50°. The mechanism is mounted in the device body 3. It is made up of: worm sector 11, worm 10, distance scale 6, knob 9, precise and approximate scale 7 (Fig. 4).

The worm sector is fixed on the axle of the mechanism body of transversal swinging (of the horizontality adjustment) and is in meshing with the worm 10, which may be rotated by means of the knobs 9.

The precise scale 5 and distances scale 6 are fixed on the worm 10, the approximate scale being marked on the body 3. On the distance scale of the open rear sight are traced a series of big and little lines, distance between two successive division corresponding to the firing distance alteration with 50 m.

The big lines are marked with figures which indicate the hectometers. For example Nr. 31 corresponds to the distance of 3100 m; Nr. 35 to the distance of 3500 m.

The precise scale 5 has 100 divisions, every tenth division being marked with figures. The approximate scale (Fig. 4; 7) has 9 equal division, every second division from "0" till "8" being marked with figures (0; 2; 4; 6; 8). A complete turning of the precise scale corresponds to a division on the approximate scale.

The dead curve of the mechanism is taken over by a spring 8, which acts the worm sector 11. The complete of the locking washer 7, limits the worm turning in an established range.

THE MECHANISM OF THE GROUND ANGLES

(Fig. 4)

The mechanism of the ground angles is designed for introducing the ground angles.

The mechanism is mounted in the apparatus body, it consists of: worm spiral wheel, knob, precise level scale 3 and approximate scale 8.

The worm is in empennage with the spiral wheel, which may be rotated by means of the knob.

The precise scale 3 is fixed on the worm and the approximate scale 8, on the body. The precise scale has 100 equal division, each 10-th division being marked with figures.

The value of a division is 0-01. The approximate scale has 3 divisions, marked with numbers 29, 30, 31 the division marked with the number 30 corresponds to the zero position of the side level.

The dead curve of the mechanism is taken over by a spring, which acts on the spiral wheel and an other spring which acts over the worm. The complete of the locking washer limits the worm turning in an established range.

THE MECHANISM OF THE TRANSVERSAL SWINGING

The mechanism of the transversal swinging is designed for the calculation of the side inclination of the rocket launcher assembly-apparatus and for bringing the apparatus in horizontal position.

The mechanism is mounted in the body. The clamping rod of the apparatus in the rocket launcher support is provided with a worm sector and is mashing with a worm, which may be turned by means of the acting knob. The dead curve of the mechanism is taken over by a spring. On the body are fixed the direct aiming telescope.

By turning of the acting knob the body together with both telescopes, are turned around the rod axis which is firmly fixed in the rocket launcher support, and thus by means of the seated transversal level on the mechanism body at sight angles of indirect aiming telescope, the equipment may be brought in horizontal position.

The clamping rod is provided with a positioning pin and with a slot for positioning and fixing of the apparatus in the rocket launcher support. For placing the transversal swinging mechanism in an average position, are used both indexes, one being on the body cover and the other being mounted on the rod.

THE LIGHTING DEVICE

It is a subassembly of the optical apparatus which is used when working with apparatus by night. It is made up of a cable with two by-passes. At the cable and there is the contact socket, which is wired to the accumulator.

At the ends of both by-passes there are two lighting fittings; the lighting fitting of the telescope reticule (for direct aiming and for indirect aiming) and lighting fitting of the mechanism scales of indirect aiming telescope. Both fittings are attached to the apparatus on the guiding in dovetail form and is fixed by some catches.

The light flux of the reticule lighting fitting is adjusted by means of a diaphragm with which is provided the body. The source of electric current is the accumulator of type NKN 13.

At the delivery, the accumulator is uncharged and will be charged by filling with electrolyte, when the apparatus is utilized for a long time by night (application, fight).

At the charging be careful that the charging liquid should exceed the accumulator plates.

After shooting of the receiver be careful that t6he terminals to be well wiped and the contacts made correctly.

The mechanical aiming device is designed for orientation of the rocket launcher towards the target when the optical aiming device is out of order.

The mechanical aiming device is made up of a fore sight and sight frame with sight slide.

The sight frame with the sight slide are introduced in the sight base and are fixed with the lock of the correction mechanism of temperatures.

Normally, the sight frame is tightened state. For firing the sight frame should be raised in vertical position and the slide is seated towards the suitable number with firing distance.

The slide is fixed in the established position by means of two dogs with spring. For introducing the corrections of temperatures on the sight base are traced scratches with signs "0", "+" and "-".

For introducing the corrections of temperatures is necessary to

Press down the lock (by means of a pin or a small stick) placed in the sight base, at the same level and moving the sight frame up and down, to arrange the traced scratch on it with the respective scratch on the sight base.

In the given position the sight frame is retained by the lock. The assembled foresight is made up of the foresight base, lock with spring, sleeve and foresight. The foresight base serves for fixing on it all the component parts of the assembly and mounting it on the barrel.

In the foresight base there are throughed holes in which are placed the sleeve and the seat for placing the lock with spring. The lock is designed to fix the foresight base in fight position (opened) and march position (shut).

The setting order of the foresight for arranging the sight line with the barrel bore axle is indicated bellow.

The tripod mount is made up of the assembled butt, the aiming devices and the tripod mount legs. All the tripod mount legs are independent one to another and may be settled according to the ground and is fixed tightly to the tripod mount.

For turning a leg is necessary to release the respective handle of the leg (to turn towards the front side) the stay to be in the wanted position and is fixed again with the handle, turning the handle backwards till tightening. Besides in the tripod mount construction is provided the possibility of simultaneous turning of both rear legs.

The legs fitting from rear are articulately fixed at the butt and are fixed in it by means of a lock and a handle placed at left of the butt.

For simultaneous turning of both rear legs is necessary to get down the handle at most after this the fittings together with stays may be turned (and fixed by restoring the handle in the horizontal position) at the desired angles, admitters by the tripod mount.

For turning the legs at a limit angle the fitting is propped in the tripod mount base. Which assure a fast setting of the tripod mount legs for firing in “lying” position or “standing” down, but in this position the rear legs and the leg fittings should be tightened by means of the handles.

For firing of the explosive bombs of 73 mm, the tripod mount assures the barrel tilting till 25^{0}, the front leg having a variable length (telescopically) in four positions:

- position "0" for the angles of -3^{o} till $+7^{o}40'$ (for antitank grenades);
- position "1" for the angles of max $+15^{o}$;
- position "2" for the angles of max $+20^{o}$;
- position "3" for the angles of $+25^{o}$.

In the established position the telescopic leg is locked by tightening of a winged screw in an elastic ear.

REMARKS

When passing the rocket launcher from the "seating" position to "lying" position it is necessary to proper the barrel on a support.

The fast mounting of the front leg in "lying" and "seating" positions for firing is assured by a catch placed in the leg joint and special lock with spring mounted on the socle – the catch limits the leg turning in "seating" position and the lock – for firing in "lying" position.

The traced scratches on the rear leg joints should be superposed only at setting the rocket launcher in the right firing position. For the barrel fastening against to tripod mount at carrying, the rocket launcher in the front side of the tripod mount has the lock device which is made up of bolt, lock and lever for fixing the platform with barrel is necessary to turn the lever up to its extreme position, clockwise. When setting the rocket launcher in the firing position the lock should be released.

In the orientation process to the target of the rocket launcher and explosive bombs cal. 73 mm at the use of the knob of the vertical aiming device, the barrel is turned on a vertical upright the axle, fixed on the tripod mount platform; at the knob turning the horizontal aiming device the barrel together with the launcher butt is turned in plane surface. The orientative aiming in vertical plane may be executed by the front or rear leg rotation and horizontal plane by moving the rocket launcher in firing position.

The operation life of the rocket launcher and the well being of their mechanisms depends on the correct handling and maintenance.

When stored and carried the rocket launcher the barrel and breech-block should be covered by the covers and the foresight and the sight leaf should be clamped up and the optical aiming device should be dismantled and put in its special packing box. After every firing the rocket launcher should be cleaned and greased.

REMARKS

After the works checking are admitted the blackening of chrome on the breechblock chamber of barrel and breechblock the chrome burning on the nozzle and pushers also creases on the contact heads and on the contact heads and on the blocking pusher. At the majority of firing numbers the blackening, the chrome burning and the creases on the indicated spots may be increased.

DISASSEMBLY, ASSEMBLY, CLEANING AND GREASING OF THE ROCKET LAUNCHER

The disassembly of the rocket launcher has the purpose its overhaul, cleaning and greasing. It is strictly forbidden the disassembly of the optical aiming device. Before the disassembly it is necessary to open the breechblock and to check if the rocket launcher is discharged. At the disassembly and assembly of the rocket launcher it is necessary to observe the followings important rules:

- use only standard tools, existing in set of tools and spare parts;
- the disassembly is performed on a table, on a clean tarpaulin or on a plywood sheet;
- the parts and the mechanisms should be set on table in their disassembly order and avoid to hit them with hard things;
- before assembling all the parts which are subjected to greasing will be wiped scrupulously and greased with lubricant.

The disassembly is performed following this order:

- take of from the rocket launcher the optical aiming device;
- for this loosen the rod tightening of the device, rotating counter clockwise the knob of device support till the rod releasing;
- take of the device from the seat and set it into its chest.
-

Disassemble the closing device and separate the breechblock from the barrel for this, are necessary. To execute the opening of the barrel bore, to turn the breechblock and to set on the lock.

- the stop lock is sunk by means of a punch and take out the reduction pushing it gradually backwards; meanwhile with the palm of the other hand it is necessary to support the stop lock of the handle stopping it to spring;
- separate the lock together with the spring;
- separate with the right hand the handle lock, raising it up with the left hand ginger;
- the handle is rotated counter clockwise about 45° and them separate the handle together with the key raising it up;
- after that the key comes out completely from the breechblock seat, the key due to its own weight falls out from the handle seat;
- sinking with a punch the breechblock axle lock the axle is pushed at most and the breechblock separated.

For dismounting the extracting mechanism it is necessary:

- to sink by a punch the axle locks to turn the catch of the lower lever clockwise;
- take out the lower lever (moving it down);
- separate the upper lever upward together with axle and is separated the lever axle;
- take out the pushers from their seats;
- separate the contacts and for this is necessary:
    - sink the push buttons by a punch, the push buttons which are in the holes of the lateral walls and contacts body, supporting the lower part of the contact by the left hand when the button is pressed, the contact falls due its own weight.

The contacts and their seats won't be greased after cleaning, but they'll be wiped by a dry cotton.

REMARKS

When the breechblock work unsatisfactorily it is necessary to be disassembled and cleaned.

For disassembling the breechblock lock it is necessary:

- to take out by means of the punch and hammer the pin of lock body, then separate the rocket launcher barrel;
- take out from the body the lock with roll and the lock spring.

The assembly of the rocket launcher after its disassembly is performed vice verse.

REMARKS

1. At the contacts mount it is necessary:

- by a punch sink successively the push buttons which are in the holes of lateral walls of the contacts body;
- supporting by left hand the lower part of the contact and push button pressing introduce the contact in its touched by the contact body lever;
- release the push button on the contacts body and contact;
- by the left hand till crack, meanwhile the push buttons which are in laterals holes of the walls of the contacts body should be come out to the initial position.

2. For checking the assembly correctness is necessary to execute several times the closing and opening of barrel bore. In the limited front position of the breechblock at handle turning the key should be freely raised and taking down the handle and breechblock should be fixed tightly and the contacts should be neatened in the contact body.

The rocket launcher should be maintained in good working and cleaning condition.

The rocket launcher which is in continuous working should be cleaned and greased after every firing march or training, and when it is stored in open air, it should be cleaned and greased every time at the pronounced changing of season (after raining, snowfall, wind with dust and so on).

For the rocket launcher cleaning and greasing shall be used:

- petroleum for slag removing from the barrel bore and the mechanism parts, after firing:
- grease for the greasing of the barrel bore and all the mechanism parts irrespective of the season and place;
- clean cotton;
- clean tows (without chaff)

For the easy cleaning of the grooves (hallows) and holes shall be used small wooden sticks, the holes for contacts shall be cleaned by means of a round bush.

For the grease dilution and washing, especially after the rocket launcher has been maintained in the stores, it is allowed to use petroleum.

After use of water or petroleum for cleaning all the parts and mechanism of the rocket launcher shall be well wiped and greased.

For the cleaning of barrel bores, of chambers, after firing it is necessary to wrap up the wiper brush by tows soaked with petroleum, then the wiper is introduced from the barrel bore into the barrel and move it along the barrel forwards and backwards with simultaneous twisting, after which the wiper is taken out.

The same operation shall be repeated introducing the wiper from the breechblock chamber (breech piece).

The chamber is cleaning by brush.

After cleaning the wiper is well wiped and the barrel bore is wiped with clean and dry tows and then with clean cotton. The cleaning is executed until the out taken is clean cotton. When the barrel is clean the inner surface of bore shall be covered by a thin grease layer. For this, clean cotton shall by wrapped on the wiper brush which is impregnated with grease and then is passed 4-5 times in the barrel bore.

Simultaneously with the barrel cleaning shall be disassembled and cleaning also the rocket launcher mechanisms, which should be subject of disassemble and cleaning.

The generator must not be disassembled it should be wiped on the outside by dry cotton and the other metal lid parts shall be slightly greased with grease.

Do not admit the grease penetration into the generator, contact and blocking device.

REPARATION OF THE ROCKET LAUNCHER FOR FIRING

For preparation of the rocket launcher for firing it is necessary:

- to pass the rocket launcher from march stat in fight state, for which it is necessary:
- rise the barrel muzzle till the breechblock shall touch the ground;
- release the rear legs locks;
- the rear legs are folded down till they touch the ground, then loosen them aside and are fix them by the leg lock handles;
- release the front leg downwards, raise it till it touches the catch and fix it by the lock handle;
- taking down the barrel muzzle the rocket launcher is seated on the legs;
- take the cover from the barrel and breech piece;
- release the lock of the march position.

This position of the tripod mount corresponded to the "lying" position.

For passing the tripod mount in the "seating" position it is necessary:

- lift the barrel muzzle of the rocket launcher and release the front leg lock;
- the front leg is turned backwards and is fixed with the handle of stays lock;
- rising the rocket launcher breech piece turn down at most the lock handle of the clamp of rear legs which then are twisted forward up to the contact;
- fix the rear legs rotating the clamping handle up to the most;
- the rocket launcher is cleaned of dust, dirt and grease in the barrel bore;
- wipe till drying the barrel bore and widened chamber;
- wipe till drying the breechblock;
- take of the optical aiming device from base, wipe and introduced it in the barrel support where it is fixed by a screw;

THE USE OF THE DEVICE

a. Precautions

For the good working of the device during the use, it is needful that at its taking of from the chest and its mounting on the rocket launcher to be proceeded with care in order to hit it not to hard things.

Also, the rotating of the acting knob of the open rear sight mechanisms and the screws from the adjusting mechanisms should be not accomplished suddenly.

At orientation of the indirect aiming telescope towards a target, the disengagement lever of the drifts mechanisms should be reduced smoothly in working position.

b. The device mounting on the rocket launcher

The device mounting on the rocket launcher is an operation that should be accomplished very carefully.

After taking of the device from the chest it should be wiped carefully the fixing lever of the device on the rocket launcher, the fixing channel and the positioning pins, for removing the grease traces or dirt which may endanger the correct positioning at the device on the rocket launcher.

The same thing is needful to be made also with the fixing device on the rocket launcher. Wipe well the inside the positioning slots and the fixing catch of the device. Rotate the acting wheel of the catch for the device fixing on the rocket launcher, until the catch reaches the lowest position.

Introduce the fixing lever of the device in the fixing device slot of the rocket launcher, being careful that the positioning pins of the device to enter perfectly into the slots of the rocket launcher device, supporting the device with a land to avoid its rotating, act by the other hand upon the acting wheel of the catch, for the device fixing, in the lock raising direction until the device fixing. It is considered that the device is well fixed when the acting wheel of the catch cannot be rotated even with a special effort.

Before the device fixing on the rocket launcher, it is needful that all the device elements – scales and indexes to be at zero, and the optical parts to be cleaned.

c. The using mode of the device

Before the firing beginning are made the following checking's:

- check up the zero positions of the rear sight for indirect firing;
- check up the aiming zero line at the telescope for indirect firing;
- check up the aiming zero line at the telescope for direct firing;

REMARKS

When firing in by night to the optical aiming device is connected the lighting system.

When firing with mechanical aiming device is necessary to awing the foresight and the sight frame.

THE CHECKING UP OF THE ROCKET LAUNCHER

Is made in the following way:

- check up the barrel; the barrel must not have bulges visible with the naked eye in the bore; when discovering such faults don't admit the launcher for firing;
- control the working of the catch and extraction mechanisms, as above indicated;
- control the presence of both contacts;
- control the working of launcher electrical mechanism and electric circuit; for this open the breechblock, introduced the test diopter in the barrel, one of the contact plates is under both the contacts of the launcher so that the upper bulb may be directed in the breechblock. The breechblock is closed;
- then execute several time the cocking and tripping on the trigger mechanism;

Meanwhile one of the firing group servants should watch the bulb through the breechblock. When the electrical firing mechanism is in good repair as the electric circuit in the bulb is lighting at every tripping. But when the fuse is connected the tripping can't be executed, since the fuse closed the tripping lever. At the breechblock opening for taking out the test diopter, take care that this may not fall on hard objects.

Check up the working of vertical and horizontal sighting mechanisms: the knobs of these mechanisms should be rotated easily and smooth.

Check up the presence and state of the tools and spare parts and accessories.

CHECK UP THE SIGHTING DEVICE

The check up of the sighting device consists of the rocket launcher preparing and the optical and mechanical aiming devices checking.

The check up of the sight consists of checking the zero line of the telescope for direct and indirect aiming.

Checking of the zero line of telescope for direct and indirect aiming is performed by the test target, fixed in front of the launcher, at a distance of 50 ± 0,05 m from the mouth of barrel, perpendicular to aiming line.

The coordinates of points APB and APO on the target for range and direction are calculated so that, at the distance of 800 m, the extension of barrel axis of the telescope for direct aiming (the test mark "+") shall intersect.

On the target, a vertical line is also traced, at a distance of 202 mm from the point APB (distance on direction, between the axis of the telescope for indirect aiming).

The target verticality is made in the following sequence:

- put the launcher in firing position, on a horizontal flat surface;
- in the scratches (marks) from the mouth of barrel, fasten straight a thin yarn of dark color with a thickness not more than 0,3 mm;
- open the breechblock, put the control diopter into the circular recess of barrel and then close the breechblock;
- set the mechanism for temperature correction of the sight at the gradation "0";
- put the launcher horizontal to the sight mechanism and the line of lead line on the target;
- aiming trough the orifice of diopter by means of the elevating and

traversing mechanism, proceed so as the crossing of barrel threads coincide with the crossing of the aiming point APB , on the target;

- put the bubble from the dial level to the middle position;
- check the zero aiming line of the telescope for direct aiming; the mark "+" on the grid must coincide with the crossing of the aiming point APO from the target;
  In case it doesn't coincide, rotate the adjusting screws until the sign "+" coincide with the crossing from the target, of the point APO.
- in order to check the aiming line "0" of the telescope of indirect aiming, put the bubble from the dial level to the middle position, acting the elevation knob of indirect telescope;
- bring the mechanism of angle of elevation to "0";
- aim trough the telescope of indirect aiming and watch the overlapping of reticule to the vertical line from target (the line being at 202 mm from APB);

In case it doesn't coincide, react on deflection micrometer up to overlapping and then adjust the angle of elevation mechanism to "0".

THE CHECKING UP OF THE REAR OPEN SIGHT

Checking up of the open rear sight is performed in the following order:

- in the marks traced at the barrel cut and depending on the results of the firing for rocket launcher adjustment, put straight a yarn of dark color, having a thickness not ore than 0,3 mm;
- open the breechblock, put the diopter into the circular recess of barrel, shut the breechblock and set the mechanism for temperature correction "0" and the slider of the sight to "4";
- aiming trough the orifice of diopter, by means of aiming mechanism, overlap the crossing of launcher threads with APB, from the test target;
- the aiming line that passes trough the notch of slider and the top of fore sight must coincide with APM. In order to do it, the fore sight is vertically adjusted (screwing or unscrewing) and horizontally (by moving the washer).

THE CHECKING UP OF ZERO POSITION OF THE OPEN REAR SIGHT FOR INDIRECT FIRING

For accomplishing this checking shall be executed followings:

1. The rocket launcher is seated on horizontal surface and the wedging surface of the rocket launcher in a nearest position to the horizontal in a transversal plane front the tripod legs.

2. The rocket launcher is brought in a horizontal position (in longitudinal plane) acting by the lifting mechanism of the barrel, by means of the seated dial on the wedging surface. The horizontal position corresponds to the mean position of the bubble from the dial level.

3. The transversal level bubble of the device is brought in a mean position by acting of the transversal swinging mechanism knob of the device.

4. In this situation check up the coincidence of zero position indexes of the distance knob and the thousands scales (precise and approximate) of the open rear sight angles mechanism. They should be coincided.

5. If the situation indicated in paragraph 4, the side level bubble of the ground angles mechanism doesn't occupy a middle position, then it should be brought in this position, operating the knob of the ground angles mechanism.

6. If, after bringing level in the indicated position paragraph 5 the indexes of the approximate and precise thousandths isn't by the division 30, respectively zero, proceed in the following way:

6.1. Loosen the 3 screws placed in the frontal side of the sleeve and rotate the precise scale of the thousandths until bringing it in coincidence of the zero division with the index after tighten the screw. Proceed with care in order to avoid diadjusting-unlaveling.

6.2. Unscrew the 2 screws and move the index till bringing it in coincidence with gradation 30^o, after then lock it up.

THE CHECKING UP OF THE AIMING ZERO LINE AT THE TELESCOPE FOR INDIRECT FIRING

This checking up may be accomplished both on the panel situated at a distance of 50 m from the rocket launcher muzzle, and also on a remote point at the minimum 800 m from the barrel bore.

For accomplishing the checking up on the remote point, are executed the following operations:

1. Seat the rocket launcher on a horizontal surface in a transversal plane.

2. On the scratches of the rocket launcher barrel bore are drawn thin threads of dark color.

3. Open the rocket launcher breechblock and introduce the diopter into the circular recess of the barrel, after that close the breechblock.

4. Sighting by the diopter orifice, by means of the rocket launcher, aiming mechanism are superposed the thread crossing from the barrel bore by a remote point at a distance of minimum 800 m by the rocket launcher.

5. the transversal level bubble is brought in the middle position by acting the knob of the transversal swinging mechanism of the device.

6. The scales of the open rear sight angles mechanism are brought in the zero position.

7. Sight by the indirect aiming telescope acting upon the drift mechanism knob until is superposed the crossing on the reticule on the same remote point. For accomplishing this superposing loosen the blocking lever of the telescope and handled the telescope till the superposing of the crossing on the reticule with the remote point, after that lock again.

8. If, after accomplishing the adjustment from the paragraph 7 the scale indexes of approximate and precise thousandths of the drift mechanism are not by the division 30, respectively zero, proceed in the following way:

8.1. Loosen the 4 screws placed in the frontal side of the knob and rotate the precise scale of the thousandths until it is brought in coincidence of the zero divisions with index after that tighten the screws.

8.2. For putting the approximate scale with gradation30 on the indexes, unscrew the two screws, loosening the plate and rotating the scale until to accomplish the incidence of the gradation 30 with indexes. After that are tighten the screws, blocking the scale.

THE CHECKING UP OF THE AIMING ZERO LINE AT THE TELESCOPE FOR DIRECT FIRNG

This checking up may be accomplished both on the panel situated at a distance of 50 m from de muzzle, and also on a remote point at minimum 800 m from the barrel bore.

For accomplishing the checking up on the remote point, execute the following operations:

1. Accomplish the operation 1, 2 and 3 from the previous point.
2. Check up if the indexes of the transversal swinging mechanism to be coincidence.
3. The rocket launcher is brought in a horizontal position in a transversal plane acting on the tripod legs. The horizontal position of the rocket launcher is when the vertical line on the direct telescope reticule is superposed with the lead thread placed at a distance of approximate 10 m of the device.
4. The temperature correction mechanism is placed in zero position.
5. Sighting by the diopter orifice by means of the aiming mechanism of the rocket launcher is superposed the thread crossing from the barrel bore with a remote point at distance of minimum 800 m from the rocket launcher.
6. Observing by the eyepiece of the aiming telescope for direct firing the sign "+" of the reticule should be superposed over the remote point. If the coincidence can't be accomplished proceed in the following way:

6.1. Loosen the screws after that raise and rotate forward both covers of the adjusting mechanism of the telescope for direct firing, allowing thus the access to the adjusting screws.

6.2. Observing then trough the eyepiece by rotating of the adjusting screws, by means of the screw driver from the bag of spare parts and accessories, shall be obtained the bringing in coincidence of the sign "+" with the remote point.

6.3. Without acting on the adjusting screws, rotate and seat the covers in their slots blocking by means of the screws.

REMARKS

In the checking up process of the aiming line of the two telescopes after various adjusting to be followed to avoid the disadjusting of the coincidence between the remote point and the barrel axis.

Check up the mechanical aiming device. For the checking up of the mechanical aiming device, seat the sight slide to the division "4" of the sight leaf, the line of sight leaf, the line of sight which is passing through the sight slide notch and the fore sight point, should not exceed the limits of the white circle of the aiming device POM on the control panel.

If the line of sight exceeds the limits of the white circle, POM adjust the sight on the vertical (by screwing up or screwing of), and on horizontal (by moving the key).

In the checking up process of the aiming devices after the control panel should be controlled periodically the correct aiming and seating of the rocket launcher.

ASSEMBLY OF THE ROUNDS TO THE GRENADE

Before firing it is necessary to examine the grenade to which shall be coupled the throwing charge and then is taken out the fuse cap from the fuse head. At firing in the rainy weather, the fuse cap won't be taken of from the fuse head. The rounds, elements which have outer damages, are not good for firing.

Till coupling the throwing charge to the grenade it is necessary to:

- open the chest and take out the charge;
- open the kit bag (with any existing means) and take out from it the grenade;
- take of from the stabilizer safety card-board tube and paper package from the fuse head side;

The grenades having damaged the connection of the stabilizer fins must not to admitted for firing. For coupling the charge to the grenade take the grenade in left hand and the throwing charge in the right, join the charge notches with lugs of grenade hilts, forcing the spring resistance, the charge is pushed to grenade forward until hearing a crack of closing of the blocking lock. Don't apply over force at coupling.

The rounds at which the power charge can't be coupled with grenades must not be admitted for firing.

For taking out the fuse cap on the head side of fuse it is necessary to draw out from the strip the safety key and then draw out the cap. This operation is executed before the rocket launcher charging.

In this form, the round is ready for charging the launcher and firing.

At firings shall be admitted only those persons who have been well assimilated the firing methods and the safety rules during the firings.

If the round was not utilized, the launcher shall be unloaded and the charge decoupled from the grenade; for this the grenade shall be taken in the left hand and keeping the charge in the right hand, with the thumb and fore-finger draw out the lock till contact overcoming the spring resistance, the charge shall be turned back the charge shall decoupled from the grenade and put in the chest.

ASSEMBLY OF THE ROUNDS EXPLOSIVE BOMBS cal. 73 mm

The rounds are brought to the firing position in chests. The taking of the throwing charges and the bombs from the chests should be accomplished on the firing position just before firing thus:

- open the case and take of the charge;
- remove the packing elements from the charge;
- the bomb will be taken in the left hand and the power charge in the right hand, join the charge notches with lugs of the bomb hilts, forcing the spring resistance till suspension, rotate the charge without over forces until locking, yielding a light crack.

After the assembling check up the mounting correctness. The round which present clearance of the stabilizer, those which have the empennage and the stabilizer ring torn or badly sewn the wet charges or with other failures must not be admitted for firing.

In the firing position during summer time the rounds shall be kept in shadow, protected against the direct action of the sun rays.

THE CHOOSING OF THE FIRING POSITION AND THE PRECAUTION MEASURES DURING THE FIRING FROM THE LAUNCHER

When choosing the firing position it is necessary to take into consideration that behind the rocket launcher must not be persons at a distance less than 30 m, ammunitions, explosive and inflammable substances and nearer of 7 m vertical strong walls. For executing these conditions should be followed more insistently during the night firing.

The firing position should be chooses thus to obtain the necessary firing field, taking into consideration the dangerous zone behind the rocket launcher.

At the firing position all the participants of the gun crew should bear steel helmet for protection by which are equipped the similarly units by the military region.

During training the firings with fight grenades in armor plated plates or tanks shall be executed at a minimum distance of 200 m because the splinters for the armor plated plate and from grenade in dispersed cases are flying till 150 m.

During firing, the first and second servant of the crew should be placed according to the launcher barrel under an angle thus to avoid the hurting possibility of the powder gaze which remain in breechblock during firing. At execution of firing in a sandy or swampy place and when it is snow, the rounds are set only on the kit bag.

Particularly, it is necessary to protect the throwing charge against moisture. It is strictly forbidden to touch the unexploded fighting grenades after firing.

These grenades are subjected to destroying even on their falling place, observing the respective precaution measures.

CHARGING AND DISCHARGING, PREPARING FOR FIRING, THE AIMING OF LAUNCHER INTO THE TARGET FIRING EXECUTION AND DRAWING OUT THE THROWING CHARGE ELEMENTS

For charging the launcher it is necessary to:

- open the breechblock;
- introduce the assembled round in the barrel breech piece and push it forward till contact;
- shut the breechblock;

The charging is executed by the second servant of the crew. Turn forward (to most) the generator handle.

The cocking of generator handle shall be executed also by the second servant of the crew, after reoccupying its place after charging.

FIRING WITH DIRECT AIMING

The firing with direct aiming is accomplished in the following way:

1. Bring in coincidence the indexes of the transversal swinging mechanism.

2. Introduce the temperature correction in the following way:

2.1. For the temperature ranges –40°C÷-10°C bring on the index the sign "-".

2.2. For the temperature ranges –10°C÷+10°C bring on the index the sign "0".

2.3. For the temperature ranges +10°C÷+50°C bring on the index the sign "+".

All these corrections are accomplished in the case of firing with cumulative rounds. At firing with explosive round should have care that the sign of temperature correction to be by position "0" on the index.

3. Act by the rocket launcher mechanisms for the target framing in the measuring scale of the target and determine the distance till the target.

4. Having thus the distance determined till the target (or commanded) is accomplished the aiming superposing on the middle of the target, the corresponding thorn of firing distance.

When the target is moving, are introduced the needful side corrections, the aiming is accomplished in this case with thorn or the vertical line corresponding on the scale "C".

When the target is moving from right to left, the aiming is accomplished by thorns or vertical lines placed in the right of the central sign and vice versa when the target is moving from left to right. The aiming is accomplished by thorns or vertical lines situated in left part of the central sign. When firing with explosive round, the aiming is accomplished superposing on the target the horizontal line on the scale "E" corresponding to the given distance till to target.

These actions (aiming) are executed by handling of the movement mechanisms in height and directions of the rocket launcher.

FIRING WITH INDIRECT AIMING

The firing with indirect aiming is accomplished in the following way:

1. Acting by a hand on the releasing lever of the worm of drift mechanism, rotate with the other hand the aiming telescope for indirect firing until the approximate scale of the drifts occupies against the indexes, am appropriate position according the commanded drift, after which stop the action on the releasing lever.

2. Acting on the drift mechanism knob bring the precise scale of thousandths to the exact value of the commanded drift.

3. Acting on the mechanism knob of the rear sight angles (or distances scale) and on the precise scale the commanded values of the rear sight angle (or distance) respectively of the ground angle.

4. Acting on the raising mechanism in height of the rocket launcher bring the level bubble of the ground angles mechanism in the middle position.

5. Acting on the knob of transversal swinging mechanism bring the transversal lever bubble in the middle position.

6. Acting on the direction movement mechanism of the rocket launcher rotate the aiming telescope for indirect firing until the vertical line of the reticule is superposed above the aiming point. If in this case the bubbles of the two levels have changed the position without modifying the aiming (vertical line of reticule remained in incoincidence by the aiming point) the bubbles are reduced in the middle position, acting again on the raising mechanism in height of the rocket launcher, and respectively on the transversal swinging mechanism of the rear sight.

THE FIRING EXECUTION BY NIGHT TIME

At the firing execution by night time proceeded in the same way as the firing by day time. For this to the reticule lighting of the two telescopes and different scales and levels is used the lighting device, described which is connected to the accumulator battery, existing in the carrying bag.

Because for the lighting of two reticules is used the same lighting body, this is moved according the needs either to the aiming telescope for indirect firing. For fixing the lighting bodies on the dovetail slide way in following way:

- push on the blocking lock at most;
- introduce the lighting body to the dovetail slide way;
- release the blocking lock, checking up if its cam has got into the notch in the dovetail slide way. In this situation, the lighting body is fixed adequately on the slide way.

REMARKS

To be sure of the good working of the lighting system by day it is necessary to wrap on objective of aiming device a rubber cover.

For aiming the rocket launcher into the target by means of the mechanical sighting device it is necessary:

- the foresight and sight frame to be set in fighting position;
- fix the necessary graduation on the temperature correction scale;
- set the sight slide on the ordered graduation on the sight frame;
- turning the knobs of the lifting and turning mechanisms, superpose the sighting line, which passes through the sight slide notch and foresight top with the aiming point.

For the fire execution it is necessary to push on the firing lever (if the firing lever was set on safety position – the first servant before hand draws out the firing lever from safety position, pushing it forward at most).

REMARKS

In case on hang fire it is necessary to wait a minute, then open completely the breechblock, turn the round at $45^0 \div 90^0$ and push again the round after that shut the breechblock, cock the generator handle and repeat the release. If the hang fire is repeated, wait a minute, than discharge the rocket launcher.

For discharging the rocket launcher in hang fire case it is necessary to set the firing lever on, safety position open slowly the breechblock till the contact and putting on the gloves draw out the round from the barrel.

The non-ignited rounds should be handed over to stores. For discharging the rocket launcher after firing it is necessary to open suddenly the breechblock; meanwhile the remained elements of throwing charge are drawn out by the pushers. If the opening of the breechblock isn't executed suddenly enough – the elements of throwing charge may come out from the barrel, but don't fall out – in this case the servant putting on the gloves draws them out manually.

If it is necessary to discharge the launcher without firing execution the firing lever should be set on safety position the breechblock opened slowly and them draw out the round from the launcher barrel. When discharging the rocket launcher, the barrel should be directed to the firing direction.

The drawn out round from barrel, according to the fight situation may be disassembled and the throwing charge seated again in its chest.

For the round disassemble it is necessary to draw the springy sleeve on the starting charge and to reverse the grenade fill superposed with the groove after this the grenade is decoupled from the starting charge.

CHARGE OF THE ROCKET LAUNCHER FROM FIGHTING POSITION FROM FIGHTING POSITION IN MARCH POSITION

For changing the rocket launcher from fighting position in march position it is necessary:

- to be convinced that the launcher is discharged and the generator handles go down;
- take out the aiming device wipe it and set it in its chest;

- grease the barrel bore and the chamber;
- protect by cover the barrel and the barrel breech piece;
- the tripod mount is clamped up for march, for this;
- the launcher barrel is located along the tripod mount axle;
- lock up the barrel to the rocket with the fixing device in march position;
- release the fixing catch of the fore leg;
- reverse the fore leg upwards (the base should make contact with the barrel) before hand disconnected the jog;
- fix the fore leg by means of the fixing catch of the legs;
- release the fixing catch of rear legs and then raise them parallel;
- the legs are turned forward, drawing them along the barrel.

In this position the rocket launcher is carried by the crew or is set in the packing case.

REMARKS

The launcher may be carried on the battle field without clamping up the legs.

THE POSSIBILES DEFECTS AND RETENTIONS OF MECHANISMS WORKING OF ROCKET LAUNCHER THEIR APPERANCE CAUSES AND THE REMOVING PROCEEDINGS

5. Hang fire.
5.1. The contact between diaphragm and contacts isn't proper.
5.2. the breechblock isn't completely closed.
5.3. The round is turned $45^o \div 90^o$.
5.4. Close the breechblock, check up if the key handle is twisted at most counter clockwise.
5.5. The electric detonator of round isn't in good order.
5.6. Replace the round.
5.7. The contacts re dirty or aren't in good repair.
5.8. Clean the contacts or exchange by new ones.
5.9. One or both contacts are not assembled.

1.10.Assemble the contact (or both contacts).

1. the round enters hardly in barrel bore.

1.1. The barrel bore or the round are dirty.

1.2. Wipe the barrel bore and the round.

1.3. Impact traces on the guiding belt of the grenade.

1.4. Replace the round.

2. The breechblock doesn't reach till the front limit (is not closed completely).

2.1. The annular groove of the barrel breech piece.

2.2. Clean the annular groove of the barrel breech piece.

2.3. The pushers are dirty.

2.4. Clean the pushers and their seats.

3. The key moves to hard at the barrel bores opening.

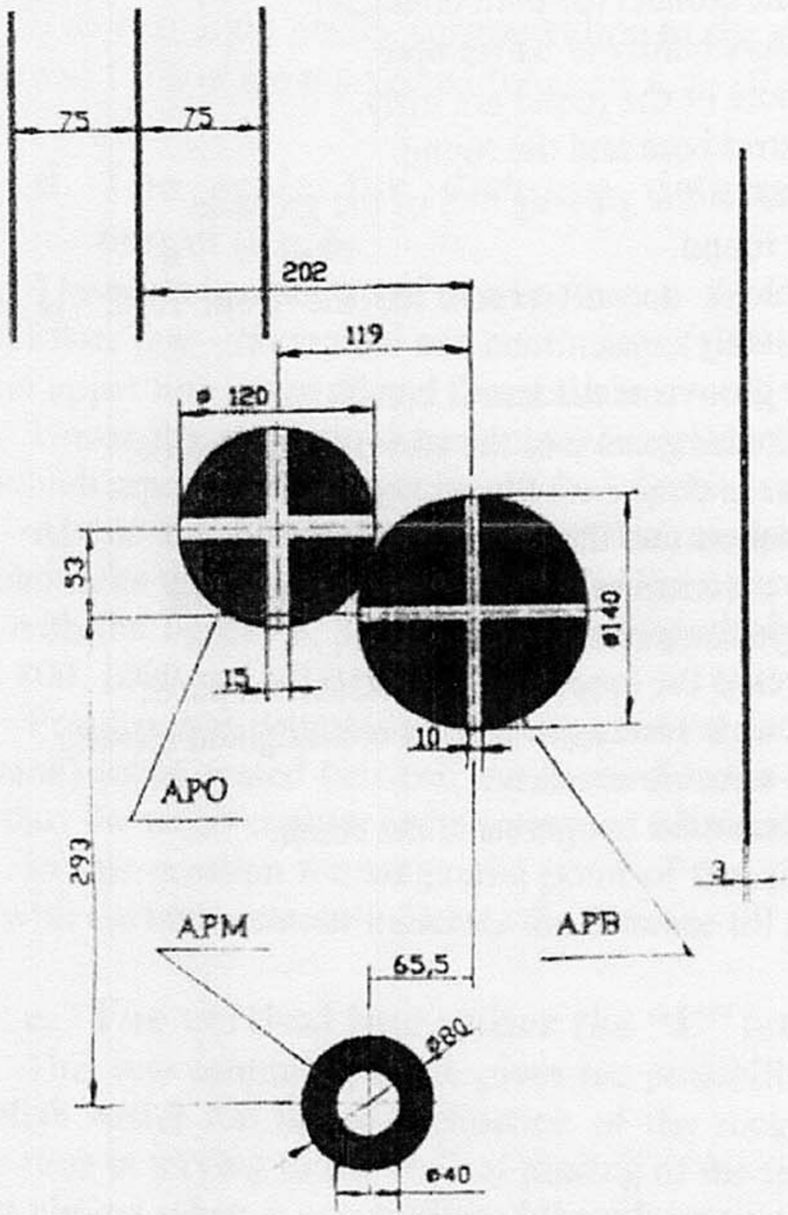
3.1. The breechblock mechanism is dirty.

3.2. Wipe and grease the breechblock mechanism parts.

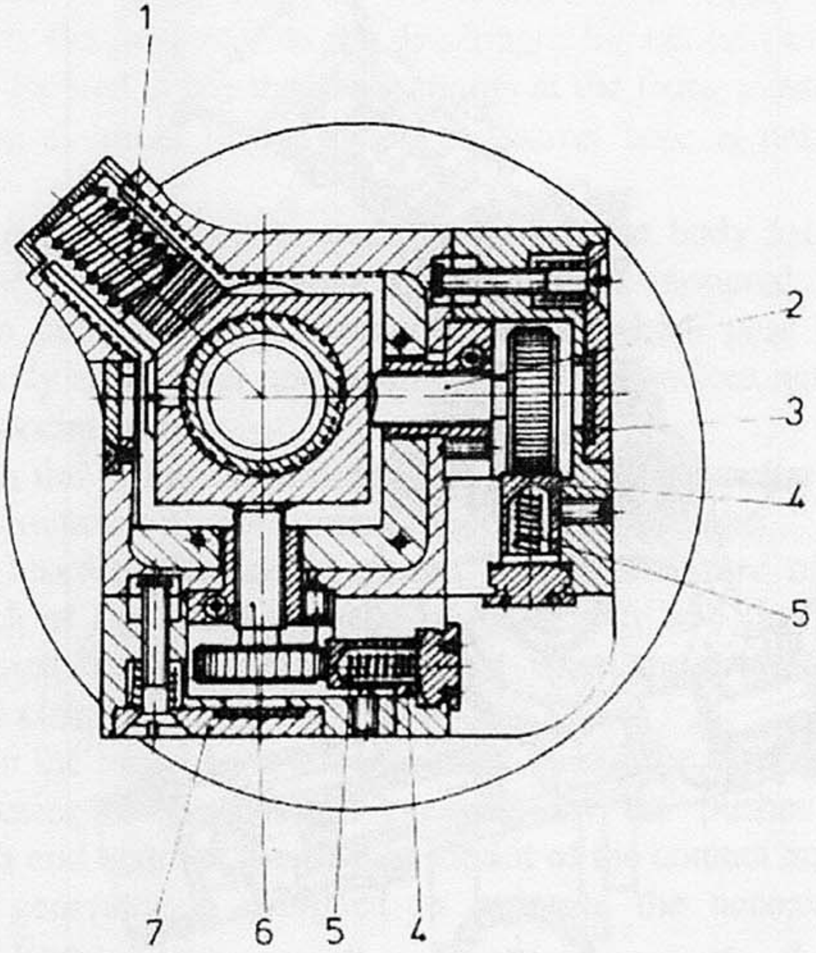
4. the breechblock is turning to hard at opening and closing.

4.1. The hangers or catch are dirty.

4.2. Clean and grease the hangers and the catch.



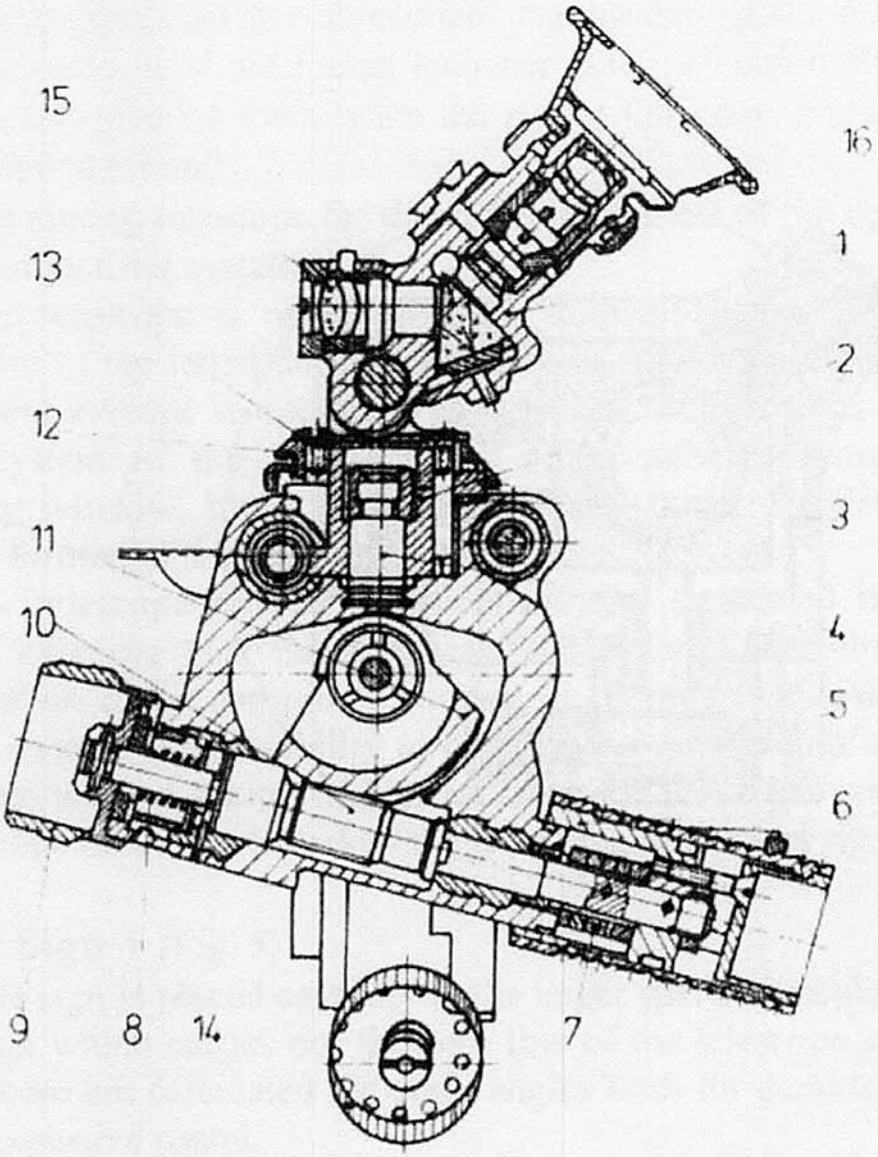
The target plan for checking up the aiming devices of the cumulative grenade and explosive bomb launcher



The control mechanism of the telescope for direct aiming

1. Spring;
2. Horizontal control screw
3. Cap;
4. Locator;
5. Spring;
6. Vertical control screw;
7. Cap.

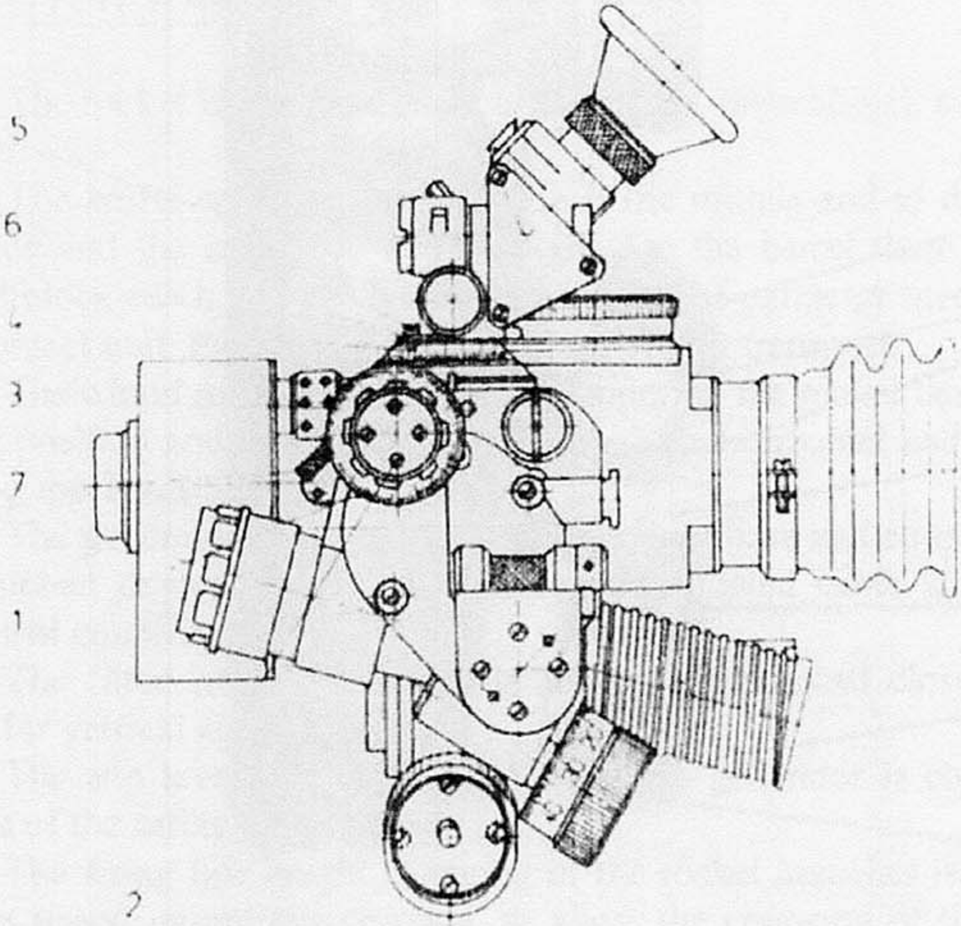
Fig. 1



Telescope for indirect aiming

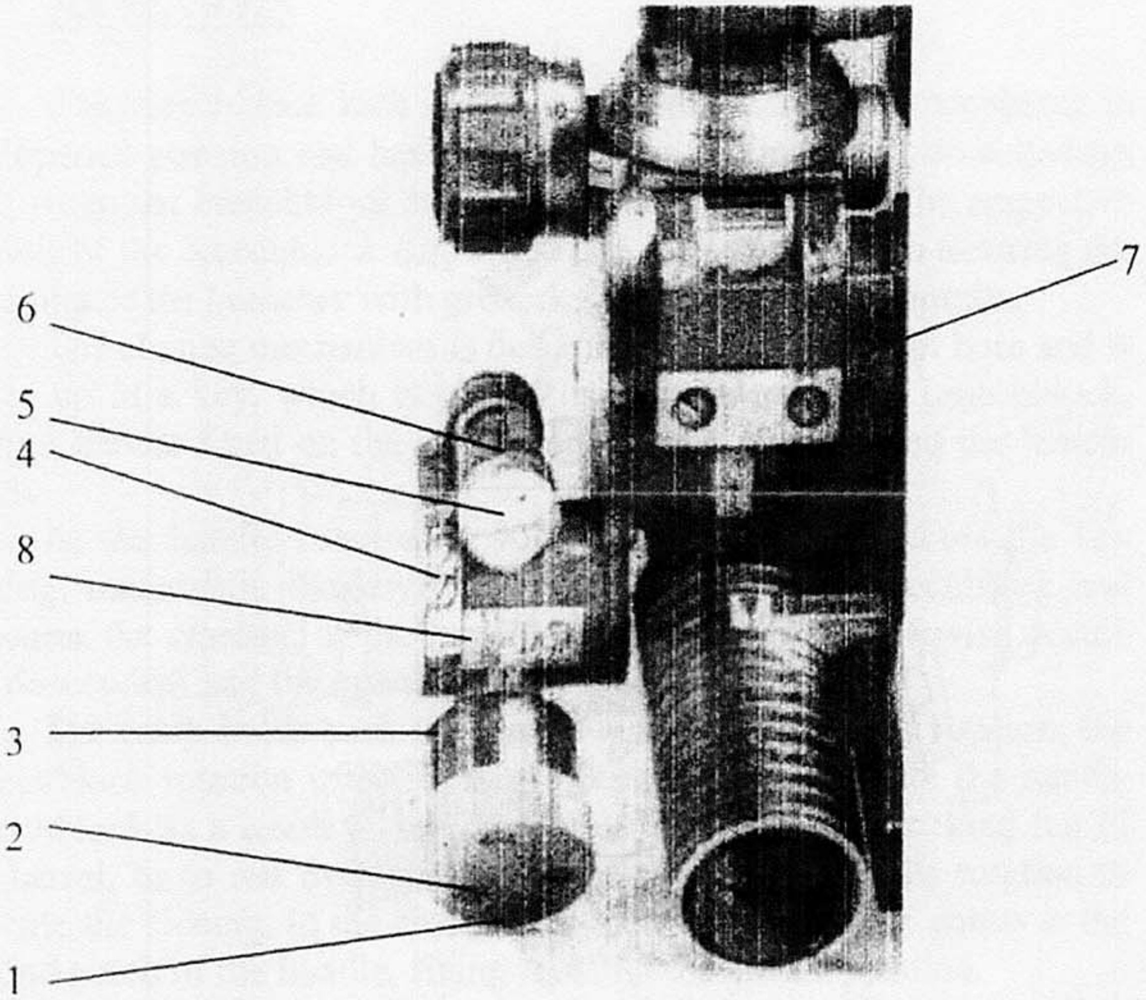
1. Case; 2. Spiral wheel; 3. Case; 4. Axle; 5. Exact scale;
6. Range drum; 7. Stopper disk; 8. Spring; 9. Drum; 10. Slug;
11. Spiral station; 12. Scale; 13. Bracket plate; 14. Driving roll;
15. Objective; 16. Eyepiece

Fig. 2



1. Drum;
2. Screws;
3. Exact scale;
4. Azimuth scale;
5. Screw;
6. Bracket plate;
7. Lever

Fig. 3



1. Drum;
2. Screws;
3. Scale;
4. Screws;
5. Nut;
6. Stop pin;
7. Approximate scale;
8. Approximate scale.

Fig. 4

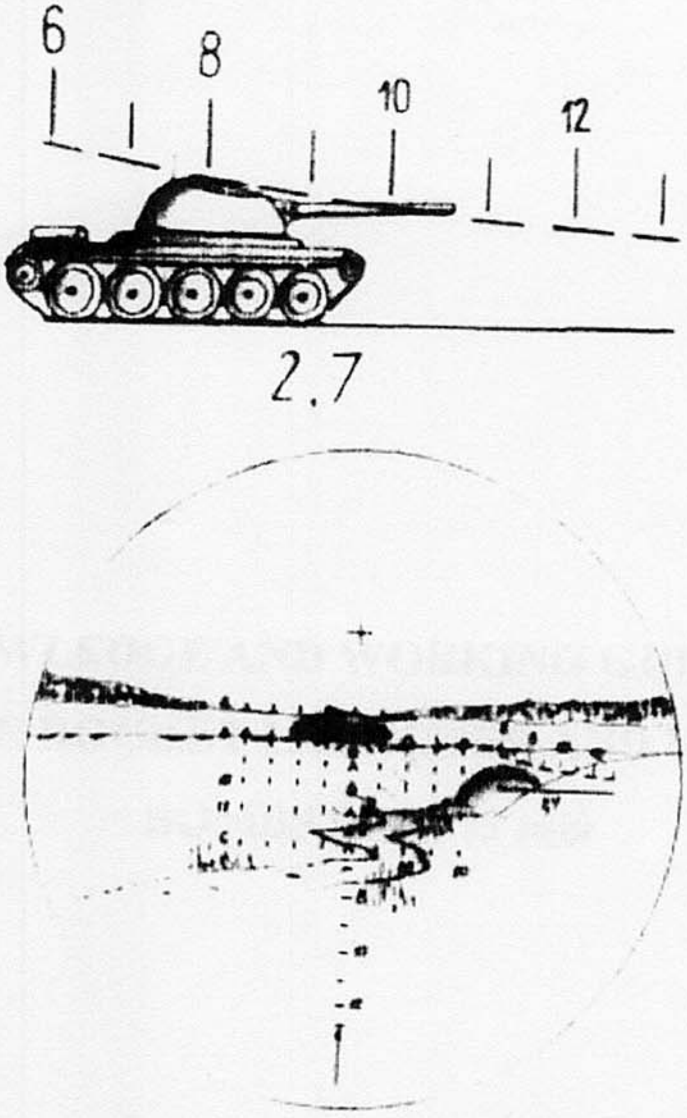


Fig. 5